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THE ROSCOE MANUAL

Volume 1-2: A Simplified ROSCOE Input Scheme

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The ROSCOE computer code is designed specifically to be the "laboratory standard" for evaluating nuclear effects on radar and optical sensors. The program provides a means for (1) evaluating radar acquisition, discrimination, and tracking performance in a nuclear environment; (2) determining optical (SWIR) effects; (3) measuring the degradation of microwave satellite communications systems due to transmission through nuclear disturbed regions; (4) estimating various radar and optical propagation error sources; and (5) computing specific phenomenological data.

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20. (Continued)

The ROSCOE documentation consists of a number of volumes, including user manuals (Volumes 1 through 3), systems code descriptions (Volumes 4, 20, and 21-1), code validation documents (Volumes 6 and 23), and phenomenology code descriptions (all others). This document has been written as an extension to the user manuals. It describes a simplified input scheme for running a subset of ROSCOE problems. It is intended for the user who only occasionally runs the code or would like to run a small problem.

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1 INTRODUCTION

In the last few years, ROSCOE (Radar and Optical Systems Code with Nuclear Effects) has been expanded to include simulations of satellite communications and optical surveillance systems in a nuclear environment. This expansion has led to considerably more complexity in the input requirements.

While the ROSCOE input scheme was devised to handle these problems (with no additional coding) and to allow the user complete flexibility in structuring scenarios with multiple sensors, objects, and bursts, it takes some time to learn how to use the system. For the user who only occasionally runs the code, or would like to run a small problem, a new input scheme has been built for running a subset of ROSCOE problems with a simple set of inputs.

The next section describes this new input scheme. Example input sets are shown for several different types of problems and the program outputs are briefly discussed. Section 3 describes how to access the new scheme, for both batch and interactive jobs. Finally, to make this paper useful as a reference guide, tables which describe the input options have been placed in Appendix A.

2 DESCRIPTION

The new ROSCOE input scheme consists of a data deck with a preselected set of input options, and a data preprocessor program which inserts user-specified values for the options into the data deck. The scheme, in general, does not sacrifice any of ROSCOE's input versatility, since a new data deck with a different set of options can be generated without writing new code.

2.1 LIMITATIONS

With the new scheme, as currently set up, the user can run nuclear burst phenomenology problems alone, or nuclear effects on radar surveillance and tracking of ballistic missiles, satellite communication, or optical surveillance and tracking, subject to these constraints:

- Up to five bursts are allowed, at altitudes up to 400 km -- positions, times, and burst properties are input.
- Only one radar can be simulated in a run -- radar characteristics and location are input.
- Only one object trajectory can be simulated in a run (although multiple objects can be spaced in time on the trajectory)--launch and impact points, impact time, and reentry angle are input.
- Only one satellite communication system can be simulated in a run (consisting of one ground transmitter, one ground receiver, and one set of satellite-borne equipment which receives and transmits) -- transmitter and receiver characteristics and locations are input.
- Only one optical sensor can be simulated in a run -- sensor characteristics and location are input.
- Run times can be no more than 900 seconds after the last burst.

2.2 INPUT VARIABLES

Input variables in the new scheme are of five types:

- General Inputs. Variables related to a reference location or time.
- Physics Inputs. Variables required to simulate a burst and print physics outputs.
- Radar Inputs. Variables required to simulate radar surveillance or tracking performance.
- Satcom Inputs. Variables required to simulate a satellite communication problem.
- Optics Inputs. Variables required to simulate optical sensor surveillance or tracking performance.

Table A.1 is a directory of input variables, divided into the five types described above with notes to indicate the options available. For each variable, the table gives its name, the number of values to be supplied (more than one if the variable is a vector), a definition of the variable including default units of measure, the default values that will be assumed if you do not input the variable, and whether a unit name is allowed for the variable. (Table A.2 shows the allowable unit names.) It is important to note the default units given. If you input values without unit names (for those variables allowing unit names), the default units are assumed. Note that the default values listed in Table A.2 are given in their customary units, which are not always the same as the internal default units.

To run a case, follow the instructions given in Table A.1, and input those variables you wish to change in the form: variable = value unit, variable = value unit, etc. End the input string with the command RUN following the last variable input. For vectors, the format may be: vector = value unit, value unit, etc., or vector(index) = value unit, value unit, etc. In the first case, the values are assigned to vector(1),

vector(2), etc,; in the second case, values are assigned to vector(index), vector(index + 1), etc. This free format is essentially compatible with the Fortran NAMELIST input scheme.

Note that positions can be specified by geographical coordinates (GEOGR), or by Cartesian (LOCXYZ) or range-azimuth-elevation (RADAR) coordinates relative to a reference location. The order of entry, orientation, and units for these specifications are given in Table A.3 and Fig. A.1.

2.3 EXAMPLE INPUT SETS

2.3.1 Physics Problem

To run a simple physics problem consisting of a single burst with the default characteristics and these assumptions:

- Burst time = 0 s
- Yield = 10 kT
- Altitude = 40 km
- Output every 20 s until 120 s after burst

input:

```
TSTØP = 120, ØTIME = 0, ØTINT = 20, BTIME1 = 0,
BPØS1(3) = 40, YIELD1 = 10 KT, RUN
```

2.3.2 Radar Problem

To run a radar surveillance problem, where:

- There is a single burst with the above properties.
- The radar is at the center of a local Cartesian coordinate system (directly under the burst).
- The radar is of the type described by the default parameters.
- The object being viewed has a -30° reentry angle and is aimed at the radar.

- The object is at 100 km altitude at time = 0 when the burst occurs.
- Radar measurements are made once every second for 20 s.

input:

TSTØP = 20, BTIME1 = 0, BPØS1(3) = 40, YIELD1 = 10 KT,
ØBTAG = ØBJECT-1, ØBTIM = 0, ØBPØS(2) = 173,
100 KM, ØBVEL(3) = -30, RADAR = REFER, RUN

2.3.3 Satcom Problem

To run a satellite communication problem, where:

- The ground transmitter and receiver are together, directly beneath a satellite at synchronous altitude (the default condition)
- The default link inputs are assumed
- The default nuclear burst (1 MT at 200 km altitude) occurs 10 s after the first communication
- The burst is displaced 200 km horizontally from the line of sight
- Communication calculations are made every 20 s, from 0 s to 100 s

input:

TSTØP = 100, BTIME1 = 10, BPØS1(2) = 200, CTIME = 0,
CTINT = 20, RUN

2.3.4 Optics Problem

To run an optical sensor surveillance problem, where:

- There is a single burst of 10 kt at 40 km altitude
- The sensor is at synchronous altitude
- The sensor is pointed at the burst

- The sensor is of the type described by the default parameters
- Sensor calculations are made at only one time (0 s)

input:

TSTØP = 1, BTIME1 = 0, BPØS1(3) = 40, YIELD1 = 10 KT,
ØBTAG = REF-ØBJECT, ØTYPE = SURVEILLANCE, ØLØØK = 0,
REFPT(1) = 40, ØPTICS = REFER, RUN

2.4 OUTPUTS

The outputs produced by the ROSCOE code using the new input scheme are described in this section. Two types of outputs may be produced: (1) printer plots, and (2) tabular outputs.

2.4.1 Printer Plots

When a high-altitude (>90 km) burst is simulated, the code produces a series of printer plots at times specified by the ØTIME, ØTINT input variables. The plots consist of a picture of the fireball and beta tube region and contour plots of mass density, electron density, and striation fraction in the high-altitude grid.

The contour plots of mass density and electron density represent vertical cross sections through the burst point in the (magnetic) north-south direction, viewed looking eastward. The contour plots of the striation fraction are cross sections normal to the earth's magnetic field, viewed looking down the field lines.

The plots are produced as they are computed internally, and thus will appear before the tabular output described below.

In addition, contour plots of the relative radiance at the focal plane of the sensor can be generated when the optics code is used. These plots are generated when the optics calculation type, OCAL , is set to FOV.

2.4.2 Tabular Outputs

There are seven phenomenology lists, five radar lists, two satellite-communication lists, and three optics lists that may be output at the conclusion of the run, depending on the type of simulation performed.

The phenomenology lists include: burst parameters, common fireball parameters (fireball set 1), two additional low-altitude fireball parameter lists (fireball set 2 and fireball set 3), additional high-altitude fireball parameters (fireball set 4), contained debris region parameters, and beta tube parameters.

The radar lists include: trajectory output, track measurement errors, track filter output, and two lists of propagation errors.

The satcom lists include: propagation and probability-of-error data, and satellite position coordinates with respect to the ground-terminal positions.

The optics output lists include: angle and signal-strength measurements for an optical tracking sensor application, the radiance along each path treated within the field-of-view, and the data stream output produced by a scanning sensor.

Table 1 shows a small sample of each type of output. Some of the column headings are self-explanatory, while others require additional comment.

TABLE 1

ROSCOE TABULAR OUTPUTS

PHENOMENOLOGY OUTPUTS

BURST PARAMETERS

TIME OF OUTPUT SEC	TOTAL ENERGY (ERGS)	FISSION ENERGY (ERGS)	BURST ALTITUDE KM	BURST PT. DENSITY (GM/CC)	SCALE HEIGHT KM	BURST PT. TEMP (DEG K)	INITIAL RADIUS KM	TIME TO REACH 3000K	TIME TO REACH 2000K
1620.000	.4183E+23	.2092E+23	250.000	.5085E-13	37.579	39037.792	212.560	0.000	0.000
1680.000	.4183E+23	.2092E+23	250.000	.5438E-12	67.922	13085.556	98.367	0.000	0.000

NOTE: Columns 9 and 10: The outputs "time to reach 3000 K and 2000 K" are used only for low-altitude (<90 km) fireball chemistry calculations.

FIREBALL SET-1

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	HORIZONTAL RADIUS KM	VERTICAL RADIUS KM	CENTER ALTITUDE KM	RISE RATE KM	EXPANSION RATE KM	FIREBALL DENSITY (GM/CC)	FIREBALL TEMP (DEG-K)	TIME SINCE BURST SEC
1630.000	1	280.533	269.073	421.588	1.671	0.000	.3621E-12	11213.966	10.000
1650.000	1	280.533	426.172	475.551	1.475	0.000	.3688E-13	8724.484	30.000

FIREBALL SET-2

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	MINIMUM ALTITUDE KM	MAXIMUM ALTITUDE KM	TILT FROM VERTICAL DEG	AXIS ROTATION DEG	HOR VORTEX RADIUS KM	VRT VORTEX RADIUS KM	VORTEX VOLUME (CM3)	CHARACT. TIME SEC
1630.000	1	164.278	690.661	.713	0.000	280.533	269.073	.8855E+23	0.000
1650.000	1	195.733	901.723	5.540	0.000	280.533	426.172	.1290E+24	0.000

NOTE: Column 6: Axis rotation is measured +CCW from North. Column 10: The characteristic time is the approximate time this fireball has merged with another (used only for low-altitude fireballs).

Table 1 (Continued)

FIREBALL SET-3

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	X-COORDINATE (CM)	Y-COORDINATE (CM)	Z-COORDINATE (CM)	OVAL OF CASSINI PARAMETER	OVAL ARM RADIUS KM	VORTEX TEMP (DEG-K)	FIREBALL KIND	MERGE ID INDEX
95.000	1	-.1150E+09	-.4636E+09	.4236E+09	.050	0.000	497.913	1	0
96.000	1	-.1150E+09	-.4636E+09	.4236E+09	.431	0.000	434.233	1	0

NOTE: Column 6: The Oval of Cassini parameter describes the shape of a low-altitude fireball. A value of 1.0 or greater means the fireball has formed a torus. Colums 9 and 10: The fireball kind can take values from 1 to 5, where: 1 = spheroid, 2 = skewed spheroid, 3 = torus, 4 = inactive radiation-merged fireball, 5 = inactive hydromerged fireball.

FIREBALL SET-4

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	X-COORDINATE (CM)	Y-COORDINATE (CM)	Z-COORDINATE (CM)	GRID CELL INDEX (X-DIR.)	GRID CELL INDEX (Y-DIR.)	GRID CELL INDEX (Z-DIR.)	FIREBALL REL. POS. IN CELL	FIREBALL KIND
1630.000	1	.8461E+08	-.4491E+09	.5031E+09	3	3	8	.894	2
1650.000	1	.8528E+08	-.4527E+09	.5071E+09	3	3	8	.894	2

NOTE: Columns 6 to 8: The grid cell indices refer to the grid cell in which the fireball center is located.

DEBRIS PARAMETERS

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	DEBRIS INDEX NUMBER	TOTAL ENERGY (ERGS)	DEBRIS ALTITUDE KM	HORIZONTAL RADIUS KM	VERTICAL RADIUS KM	DEBRIS DISTRIB. PARAMETER	EQUIVALENT SPH. RAD. KM	DEBRIS VOLUME (C-3)
95.000	1	1	.8366E+20	8.826	.053	.052	8.000	.052	.6681E+12
96.000	1	1	.8366E+20	8.804	.090	.080	8.000	.087	.2502E+13

NOTE: Column 8: The debris distribution parameter describes the rate of fall-off of the beta source strength from the tube boundary (see RANC IV).

Table 1 (Continued)

BETA TUBE PARAMETERS

TIME OF OUTPUT SEC	FIREBALL INDEX NUMBER	BETA TUBE SHAPE	INITIAL DIP ANGLE DEG	KINK ANGLE FROM HORIZ DEG	KINK-BURST DISTANCE KM	N-S RADIUS AT 85KM KM	E-W RADIUS AT 85KM KM	N-S RADIUS AT 60KM KM	E-W RADIUS AT 60KM KM
1630.000	1	KINK	76.306	76.674	40.259	203.819	207.111	202.547	206.309
1650.000	1	KINK	76.306	77.821	48.328	201.169	205.439	199.915	204.644

NOTE: Column 3: The beta tube shape is either "STRAIGHT" or "KINK". Column 6: The kink-burst distance is the distance from the sub-burst point at 85 km to the center of the beta tube at 85 km.

RADAR CUTPUTS

TRAJECTORY OUTPUT

TYPE OF EVENT	TIME OF OUTPUT SEC	POSITION ALTITUDE M	DATA FOR RANGE M	OBJECT AT AZIMUTH DEG	SPECIFIED ELEVATION DEG	TIME---- VELOCITY M	---------- SIGNAL TO NOISE (DB)	NUMBER OF TARGETS
SEARCH	1599.497	939669.277	3296670.933	81.224	2.722	6226.094	19.879	1
VERIFY	1599.597	939533.118	3296080.308	81.223	2.725	6226.259	20.575	1

NOTE: Column 1: The event type is either "SEARCH", "VERIFY", "TRACK IN" (for track initiation), or "TRACK". Columns 3 to 7: The position and velocity data given here are the actual values. Column 9: The number of targets can be zero if the target has been lost, one if a single target has been locatec, or more than one if multipath effects occur.

TRACK MEASUREMENT ERRORS

TIME OF OUTPUT SEC	PREDICTED RANGE M	PREDICTED AZIMUTH DEG	PREDICTED ELEVATION DEG	MEASURED RANGE M	MEASURED AZIMUTH DEG	MEASURED ELEVATION DEG	RANDOM RANGE M	ERRORS--IN AZIMUTH DEG	RAE COURDS ELEVATION DEG
1599.497	3296670.933	81.224	2.722	3296610.359	81.182	2.604	-50.574	0.000	0.000
1599.597	3296080.308	81.223	2.725	3296211.211	81.182	2.604	130.903	0.000	0.000

NOTE: Columns 2 to 4 and 5 to 7: The predicted position is either equivalent to the actual position for search pulses or is the position predicted by the track filter once track has been initialized. The measured coordinates are those generated during the current look and include all refraction and radar measurement errors.

Table 1 (Continued)

TRACKING ERRORS

TIME OF OUTPUT SEC	ERRORS IN ALONG V M	POSITION---- PERP TO V M	---------- ACROSS V M	ERRORS IN ALONG V M	VELOCITY-- PERP TO V M	---------- CROSS V M	APPARENT RANGE M	TARGET AZIMUTH DEG	POSITION ELEVATION DEG
1616.897	512.146	1548.965	-57.792	1718.544	6988.306	-2792.826	3193576.724	80.954	3.256
1617.897	312.660	913.497	1983.290	451.091	2282.409	384.810	3187482.417	80.938	3.286

NOTE: Columns 2 to 7 and 8 to 10: The errors in position and velocity are the difference between the filter prediction and actuals. The apparent target coordinates are the actual coordinates plus refraction and multipath errors before radar measurement errors have been added.

PROPAGATION OUTPUT--I

TIME OF OUTPUT SEC	ABSORPTION FROM ALL SOURCES	THRESHOLD ABSORPTION	NOISE TEMP.	NOISE POWER	CLUTTER-TO-NOISE RATIO (DB)	DISPERSIVE LOSS	FARADAY ROTATION LOSS	FAILURE MODE
1599.497	0.000	7.266	0.000	.2465E-09	0.000	1.000	1.000	NO FAILURE
1599.597	0.000	7.563	0.000	.2485E-09	0.000	1.000	1.000	NO FAILURE

NOTE: Column 9: The failure mode flag can have the following messages:

NO FAILURE	S/N received is above threshold
RANGE	The radar is range (power) limited for this target
ABSORPTION	The absorption due to all sources has reduced the S/N below threshold
ABS+NOISE	The combination of absorption and fireball noise has reduced the S/N below threshold
TOTAL	The combination of absorption, noise, dispersion, and Faraday rotation has dropped the S/N below threshold
LOW SIGNAL	The combination of the above effects and refraction or clutter has dropped the S/N below threshold
NO TARGET	There are no targets within the range gate and 3 dB beamwidth

Table 1 (Continued)

PROPAGATION OUTPUT-2

TIME OF OUTPUT SEC	BIAS RANGE M	REFRACTION AZIMUTH DEG	ERRORS ELEVATION DEG	RANDOM RANGE M	REFRACTION AZIMUTH DEG	ERRORS ELEVATION DEG
1599.497	0.000	0.000	0.000	0.000	0.000	0.000
1599.597	0.000	0.000	0.000	0.000	0.000	0.000

SATCOM OUTPUTS

COMMUNICATIONS OUTPUT -1

TYPE OF OUTPUT	TIME OF OUTPUT SEC	UPLINK LOSS FACTOR	UPLINK SCINT	DOWNLINK LOSS FACTOR	DOWNLINK SCINT	PROB. OF ERROR SATELLITE	PROB. OF ERROR GROUND	PROB. OF ERROR
CCM-RECEVD	1612.000	1.001	0.	1.605	0.	0.	0.	0.
CCM-RECEVD	1622.000	22.993	9526.6	60.143	10230.	.25850E-03	.12247E-01	.12500E-01

NOTE: Columns 3 to 6: The uplink and downlink loss factors are the losses due to absorption from all sources (dimensionless). The uplink and downlink scintillation values refer to the standard deviation in phase due to scintillation effects in radians.

COMMUNICATIONS OUTPUT -2

TIME OF OUTPUT SEC	SATELLITE RANGE KM	COORD XMT AZIMUTH DEG	TRANSMITR ELEVATION DEG	SATELLITE RANGE KM	COORD RRT AZIMUTH DEG	RECEIVER ELEVATION DEG
1612.000	1306.105	-86.892	74.592	1306.105	-86.892	74.592
1622.000	1291.663	-86.922	77.718	1291.663	-86.922	77.718

Table 1 (Continued)

OPTICS OUTPUT

OPTICAL MEASUREMENTS

TIME OF OUTPUT SEC	CENTRAL WAVELENGTH M	ACTUAL AZIMUTH (RADIANS)	ACTUAL ELEVATION (RADIANS)	MEASURED AZIMUTH (RADIANS)	MEASURED ELEVATION (RADIANS)	ESTIMATED AZIMUTH (RADIANS)	ESTIMATED ELEVATION (RADIANS)	IRRADIANCE AT SENSOR (W/CM2)	SIGNAL-TO-NOISE (DB)
0.000	.4195E-05	0.	0.	0.	0.	0.	0.	0.	0.

NOTE: Actual, measured, and estimated coordinates are measured in angular units relative to the sensor boresight.

INTEGRATED PATH DATA

TIME OF OUTPUT SEC	CENTRAL WAVELENGTH M	AZIMUTH OFF-BORE (RADIANS)	ELEVATION OFF-BORE (RADIANS)	RADIANCE (PHOTONS/SEC-M-SR)	INTEGRATED RADIANCE	SIGMA DUE TO STRUCTURE
10.000	.2550E-05	-.4273E-14	0.	.6031E+22	.6930E+22	0.
10.000	.2550E-05	.6242E-05	.1047E-03	.3295E+15	.3295E+15	0.
10.000	.2550E-05	-.6242E-05	-.1047E-03	.3292E+15	.3292E+15	0.

NOTE: The radiance in Column 5 is the integrated radiance along the path (described by the azimuth and elevation off-boresight) due to all emission and scattering sources. The integrated radiance in Column 6 is just radiance integrated over all band intervals and the signal due to structure (Column 7) is the deviation in the integrated radiance due to striated (or structured) regions along the path.

OPTICAL SAMPLES

TIME OF OUTPUT SEC	DETECTOR NUMBER	CENTRAL WAVELENGTH	AZIMUTH OFF-BORE (RADIANS)	ELEVATION OFF-BORE (RADIANS)	SCANNED SIGNAL OUTPUT	NORMALIZED SIGNAL OUTPUT	FINAL SIGNAL OUTPUT	TARGET DETECTION FLAG
0.000000	1.000	.4195E-05	-.2500E-03	-.2770E-16	.1472E-07	.4293	.1079	BKGND
.000018	1.000	.4195E-05	-.2450E-03	.5450E-06	.6640E-07	1.939	.5942	BKGND
.000036	1.000	.4195E-05	-.2350E-03	.1070E-05	.6587E-07	2.038	.9384	BKGND

NOTE: The last four columns show the scanned signal output (irradiance at the detector), the normalized signal output (the irradiance normalized to the sensor NEFD). the final signal output (after all other processing such as differencing has been completed), and the target detection flag which signifies whether the final signal exceeds a preset threshold designating the point a "TARGET" versus a "BKGND" point.

3 ACCESSING THE INPUT SCHEME

3.1 BATCH JOBS

To access and use the new input scheme in the batch mode (i.e., by submitting a card input deck over the counter or through a remote terminal), use a deck setup such as that shown in Table A.4.

Note that an optional card may precede the data cards, directing the input program to print each default card changed, followed by the new card which replaces it.

3.2 INTERACTIVE JOBS

To access and use the new input scheme using the time-share system follow these steps (also shown in Table A.6). (First, you must have a procedure permfile containing a small CYBER control language "PRØC" and a set of control cards. A sample procedure permfile is shown in Table A.5)

Step 1. Access your procedure file with the ATTACH statement.

Step 2. Execute the ROSCOE time-share program by typing RØSCØTS.

Step 3. Type your inputs, in response to the program's message "INPUTS?". The program then processes the inputs; that is, inserts them into the standard deck and checks for errors. If errors occur, the program prints them and asks you to input a revised list by again asking "INPUTS?". When no errors occur, terminate RØSCØTS by typing "RUN". The job file is then automatically placed in the input queue, and control returns to the INTERCOM system. You can check that your job has been accepted by typing a FIND, nnn command, where nnn is the first 1-5 characters of the job name (first parameter on your first control card).

APPENDIX A

USER REFERENCE TABLES

TABLE A.1

A DIRECTORY OF INPUT VARIABLES

DIRECTORY OF INPUT VARIABLES 02/04/80 10.36.18. PAGE 1

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
		SIMPLIFIED ROSCOE INPUT LIST			
		A. GENERAL INPUTS			
		--THE DEFAULT VALUES ARE SET SO THAT THE CODE PROCESSES THE STOP EVENT FIRST AND THUS PRODUCES NO OUTPUT. --TO RUN A PHYSICS AND/OR RADAR, SATCOM, OR OPTICS PROBLEM CHANGE THE EVENT TIMES DESCRIBED BELOW TO OCCUR BEFORE THE STOP TIME.			
TSTOP	1	TSTOP = PROBLEM STOP TIME (DEFAULT UNIT IS SEC)	0.	SEC	YES
REFALT	1	REFALT = REFERENCE POSITION ALTITUDE(KM)	0.		NO
REFLON	1	REFLON = REFERENCE POSITION EAST LONGITUDE(DEG)	-79.33		NO
REFLAT	1	REFLAT = REFERENCE POSITION NORTH LATITUDE(DEG)	47.75		NO
EVNLST	1	EVNLST = FLAG TO SUPPRESS EVENT LIST OUTPUT(IF UNITY) (IF ZERO, A SINGLE OUTPUT LINE IS PRINTED FOR EACH EVENT PROCESSED.	1.		NO
ACELL	1	ACELL = ANGULAR CELL SIZE OF HIGH ALTITUDE (ABOVE 90 KM) GRID (RAD)	.02		NO
KREG	1	KREG = REGION TYPE FOR AEROSOL CONTENT (1=RURAL, 2=URBAN, 3=MARITIME)	1.		NO
KVIS	1	KVIS = VISIBILITY PARAMETER FOR AEROSOL CONTENT (1=50KM, 2=23KM, 3=10KM, 4=5KM, 5=2KM)	1.		NO
MSM	1	MSM = INDEX FOR CATEGORY OF SURFACE MATERIAL (1=LAMBERTIAN DIFFUSE SURFACE, 2=WATER, 3=SNOW, 4=SAND, 5=SOIL, 6=FOLIAGE, 7=URBAN)	1.		NO
DD	1	DD = ADDITIONAL DESCRIPTOR FOR SELECTED SURFACE MATERIAL (MSM=1,DD= DIFFUSE REFLECTANCE--LIKE .01/ MSM=2,DD=WIND SPEED (M/SEC)/ MSM=3,DD=SNOW-AGE PARAMETER--0.-1.0/ MSM=4,5,6,DD=NOT USED/ MSM=7,DD=DEGREE OF URBANIZATION--FLAT TO DIFFUSE--0.-1.0)	.01		NO
CLOUDS	1	CLOUDS = FLAG FOR CONSIDERATION OF STATISTICAL CLOUDS IN CALCULATION (SET CLOUDS=HEREH TO INCLUDE STATISTICAL CLOUDS, OTHERWISE SET CLOUDS=ZEROS)	ZEROS		NO
		B. PHYSICS CODE INPUTS			
		--TO RUN A PHYSICS PROBLEM, INPUT THE BURST TIMES (BTIME1,BTIME2,ETC) TO OCCUR PRIOR TO TSTOP. --FOR EXAMPLE--BY INPUTTING BTIME1=0.,TSTOP=120. SEC, THE CODE SIMULATES A SINGLE BURST FOR TIMES OUT TO 120 SEC AFTER BURST.			

DIRECTORY OF INPUT VARIABLES
Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
		1. RUN CONTROL			
		--THE CODE PROVIDES ONLY BURST PARAMETER OUTPUT BY DEFAULT. TO GET TIME DEPENDENT FIREBALL AND DEBRIS PROPERTIES AT REGULAR INTERVALS, INPUT (OTIME) AND (OTINT). --FOR EXAMPLE--BY INPUTTING BTIME1=0. SEC,OTIME=1. SEC OTINT=30. SEC, THE CODE WILL OUTPUT PHYSICS DATA STARTING AT 1 SEC AFTER BURST AND PRINT OUTPUT EVERY 30 SEC THEREAFTER UNTIL THE STOP TIME IS REACHED.			
OTIME	1	OTIME = PHYSICS OUTPUT TIME (DEFAULT UNIT IS SEC)	99999.	SEC	YES
OTINT	1	OTINT = PHYSICS OUTPUT DATA TIME INTERVAL (DEFAULT UNIT IS SEC)	30.	SEC	YES
		2. BURST DATA			
		--UP TO FIVE BURSTS ARE ALLOWED. --THE USER CAN CHOOSE TO INPUT BURST COORDINATES IN GEOGRAPHICAL COORDINATES (GEOGR) OR COORDINATES RELATIVE TO THE REFERENCE LOCATION IN SECTION A. ABOVE (LOCXYZ OR RADAR). --FOR EXAMPLE--THE USER CAN INPUT BPOS1=0.,50.,50.,LOCXYZ AND BURST 1 IS SPECIFIED IN A CARTESIAN EAST-NORTH-UP (XYZ) COORDINATE SYSTEM.			
BTIME1	1	BTIME1 = BURST TIME FOR BURST 1 (DEFAULT UNIT IS SEC)	99999.	SEC	YES
BTIME2	1	BTIME2 = BURST TIME FOR BURST 2 (DEFAULT UNIT IS SEC)	99999.	SEC	YES
BTIME3	1	BTIME3 = BURST TIME FOR BURST 3 (DEFAULT UNIT IS SEC)	99999.	SEC	YES
BTIME4	1	BTIME4 = BURST TIME FOR BURST 4 (DEFAULT UNIT IS SEC)	99999.	SEC	YES
BTIME5	1	BTIME5 = BURST TIME FOR BURST 5 (DEFAULT UNIT IS SEC)	99999.	SEC	YES
BPOS1	4	BPOS1(1-4) = BURST COORDINATES FOR BURST 1. COORDINATE(1)=ALTITUDE(KM), X-COORD(KM), OR RANGE(KM). COORDINATE(2)=EAST LONGITUDE(DEG), Y-COORD(KM), OR AZIMUTH CCW FROM EAST(DEG). COORDINATE(3)= NORTH LATITUDE(DEG), Z-COORD(KM), OR ELEVATION(DEG). COORDINATE(4)=COORD TYPE (GEOGR,LOCXYZ, OR RADAR).	0. 0. 200. LOCXYZ		NO NO NO NO
BPOS2	4	BPOS2(1-4) = BURST COORDINATES FOR BURST 2 (SEE BPOS1 DESCRIPTION)	0. 0. 200. LOCXYZ		NO NO NO NO
BPOS3	4	BPOS3(1-4) = BURST COORDINATES FOR BURST 3 (SEE BPOS1 DESCRIPTION)	0. 0. 200. LOCXYZ		NO NO NO NO
BPOS4	4	BPOS4(1-4) = BURST COORDINATES FOR BURST 4 (SEE BPOS1 DESCRIPTION)	0. 0. 200. LOCXYZ		NO NO NO NO
BPOS5	4	BPOS5(1-4) = BURST COORDINATES FOR BURST 5 (SEE BPOS1 DESCRIPTION)	0.		NO

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Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
			0.		NO
			200.		NO
			LOCXYZ		NO
		3. WEAPON DATA			
		--UP TO FIVE WEAPON TYPES CAN BE ENTERED.			
		--X-RAY TEMPERATURES ARE LIMITED TO THE THREE VALUES LISTED.			
YIELD1	1	YIELD1 = YIELD OF BURST 1 (DEFAULT UNIT IS MT)	1.0	MT	YES
YIELD2	1	YIELD2 = YIELD OF BURST 2 (DEFAULT UNIT IS MT)	1.0	MT	YES
YIELD3	1	YIELD3 = YIELD OF BURST 3 (DEFAULT UNIT IS MT)	1.0	MT	YES
YIELD4	1	YIELD4 = YIELD OF BURST 4 (DEFAULT UNIT IS MT)	1.0	MT	YES
YIELD5	1	YIELD5 = YIELD OF BURST 5 (DEFAULT UNIT IS MT)	1.0	MT	YES
FFRAC1	1	FFRAC1 = FISSION FRACTION OF BURST 1	.10		NO
FFRAC2	1	FFRAC2 = FISSION FRACTION OF BURST 2	.10		NO
FFRAC3	1	FFRAC3 = FISSION FRACTION OF BURST 3	.10		NO
FFRAC4	1	FFRAC4 = FISSION FRACTION OF BURST 4	.10		NO
FFRAC5	1	FFRAC5 = FISSION FRACTION OF BURST 5	.10		NO
HFRAC1	1	HFRAC1 = HYDRO FRACTION OF BURST 1	.24		NO
HFRAC2	1	HFRAC2 = HYDRO FRACTION OF BURST 2	.24		NO
HFRAC3	1	HFRAC3 = HYDRO FRACTION OF BURST 3	.24		NO
HFRAC4	1	HFRAC4 = HYDRO FRACTION OF BURST 4	.24		NO
HFRAC5	1	HFRAC5 = HYDRO FRACTION OF BURST 5	.24		NO
NFRAC1	1	NFRAC1 = NEUTRON FRACTION OF BURST 1	.01		NO
NFRAC2	1	NFRAC2 = NEUTRON FRACTION OF BURST 2	.01		NO
NFRAC3	1	NFRAC3 = NEUTRON FRACTION OF BURST 3	.01		NO
NFRAC4	1	NFRAC4 = NEUTRON FRACTION OF BURST 4	.01		NO
NFRAC5	1	NFRAC5 = NEUTRON FRACTION OF BURST 5	.01		NO
XFRAC1	1	XFRAC1 = X-RAY FRACTION OF BURST 1	.75		NO
XFRAC2	1	XFRAC2 = X-RAY FRACTION OF BURST 2	.75		NO
XFRAC3	1	XFRAC3 = X-RAY FRACTION OF BURST 3	.75		NO
XFRAC4	1	XFRAC4 = X-RAY FRACTION OF BURST 4	.75		NO
XFRAC5	1	XFRAC5 = X-RAY FRACTION OF BURST 5	.75		NO
GFRAC1	1	GFRAC1 = GAMMA FRACTION OF BURST 1	.001		NO
GFRAC2	1	GFRAC2 = GAMMA FRACTION OF BURST 2	.001		NO
GFRAC3	1	GFRAC3 = GAMMA FRACTION OF BURST 3	.001		NO
GFRAC4	1	GFRAC4 = GAMMA FRACTION OF BURST 4	.001		NO
GFRAC5	1	GFRAC5 = GAMMA FRACTION OF BURST 5	.001		NO
WMASS1	1	WMASS1 = WEAPON MASS OF BURST 1 (DEFAULT UNIT IS GM)	1.5E6	GM	YES
WMASS2	1	WMASS2 = WEAPON MASS OF BURST 2 (DEFAULT UNIT IS GM)	1.5E6	GM	YES
WMASS3	1	WMASS3 = WEAPON MASS OF BURST 3 (DEFAULT UNIT IS GM)	1.5E6	GM	YES
WMASS4	1	WMASS4 = WEAPON MASS OF BURST 4 (DEFAULT UNIT IS GM)	1.5E6	GM	YES
WMASS5	1	WMASS5 = WEAPON MASS OF BURST 5 (DEFAULT UNIT IS GM)	1.5E6	GM	YES
XTEM1	1	XTEM1 = X-RAY TEMPERATURE (KEV) OF BURST 1 -- (0.5,1.0, OR 2.0) (MUST BE TYPED LITERALLY -- E.G. 0.5 ,NOT .5)	1.0		NO

Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
XTEM2	1	XTEM2 = X-RAY TEMPERATURE (KEV) OF BURST 2 -- (0.5,1.0, OR 2.0) (MUST BE TYPED LITERALLY -- E.G. 0.5 ,NOT .5)	1.0		NO
XTEM3	1	XTEM3 = X-RAY TEMPERATURE (KEV) OF BURST 3 -- (0.5,1.0, OR 2.0) (MUST BE TYPED LITERALLY -- E.G. 0.5 ,NOT .5)	1.0		NO
XTEM4	1	XTEM4 = X-RAY TEMPERATURE (KEV) OF BURST 4 -- (0.5,1.0, OR 2.0) (MUST BE TYPED LITERALLY -- E.G. 0.5 ,NOT .5)	1.0		NO
XTEM5	1	XTEM5 = X-RAY TEMPERATURE (KEV) OF BURST 5 -- (0.5,1.0, OR 2.0) (MUST BE TYPED LITERALLY -- E.G. 0.5 ,NOT .5)	1.0		NO

C. RADAR CODE INPUTS

--TO RUN A RADAR PROBLEM THE USER MUST FIRST SET RADAR=REFER

--RADAR PROBLEMS CAN THEN BE SET UP IN TWO WAYS--
(1) AN OBJECT POSITION,VELOCITY AND TIME CAN BE INPUT (SEE OBJECT DATA -STATE VECTOR INPUT BELOW) AND THE FIRST RADAR LOOK WILL BE INITIATED AT THE OBJECT TIME SPECIFIED, OR
(2) THE USER SPECIFIES AN OBJECT TRAJECTORY (SEE OBJECT DATA -TRAJECTORY INPUT) AND THE FIRST RADAR LOOK IS ESTABLISHED WHEN THE OBJECT ENTERS THE RADAR FOV.

---

1. RUN CONTROL

--INDEPENDENT RADAR LOOKS OR CLOSED LOOP TRACK IS SELECTED BY SETTING (KFLAG).
--SUBSEQUENT LOOKS ARE CREATED INTERNALLY EVERY (DT) SEC.

RADAR	1	RADAR = FLAG FOR INITIALIZING RADAR PROBLEM (SET RADAR=REFER FOR RADAR CALCULATIONS)	ZEROS		NO
KFLAG	1	KFLAG = FLAG FOR CLOSED LOOP TRACK (0=TRACK, 1=NO TRACK/SEARCH ONLY)	1.0		NO
DT	1	DT = RADAR LOOK (OR TRACK) INTERVAL (DEFAULT UNIT IS SEC)	1.0	SEC	YES

2. RADAR DATA

--THE RADAR LOCATION CAN BE INPUT IN GEOGRAPHICAL COORDINATES (GEOOR) OR RELATIVE TO THE REFERENCE LOCATION IN SECTION A. ABOVE.
--FOR EXAMPLE-- THE DEFAULT VALUES FOR RDPOS PLACE THE RADAR AT THE ORIGIN OF THE CARTESIAN EAST-NORTH-UP

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DIRECTORY OF INPUT VARIABLES
Table A.1 (Continued)                                                                      DEFAULT                UNIT-NAME
  INPUT      NO.                                                                           VALUES                 ALLOWED
VARIABLE   VALUES                        DESCRIPTION
---------  -------  ------------------------------------------------------------------    -----------------     -------

                              (XYZ) COORDINATES MENTIONED EARLIER.

                                                                                           0.                      NO
ROPOS         4      ROPOS(1-4) = RADAR POSITION (ROPOS(1-3)=POSITION COORD,ROPOS(4)=      0.                      NO
                              COORD TYPE--GEODR,LOCXYZ, OR RADAR)  DISTANCES ARE IN KM.    0.                      NO
                              ANGLES IN DEG.                                               LOCXYZ                  NO
                                                                                           90.                     NO
BORE          2      BORE(1-2) = RADAR BORESIGHT DIRECTION (AZIMUTH CCW FROM EAST, AND     25.                     NO
                              ELEVATION IN DEG)                                            450.        MHZ         YES
FREQ          1      FREQ = RADAR FREQUENCY(DEFAULT UNIT IS HZ)                            2500.       NMSGM       YES
RSOM          1      RSOM = RADAR RANGE ON 1-SQ-M TARGET (UNITS AVAILABLE AS UNIT-NAMES ARE
                           NMSGM, NMSGM, MFSGM OR THE DEFAULT UNIT CMSGCM)                 1.5         DEG         YES
BEAMW         1      BEAMW = RADAR BEAMWIDTH (DEFAULT UNIT IS RADIANS)                     1800.       NM          YES
RMAX          1      RMAX = MAXIMUM DETECTION RANGE(DEFAULT UNIT IS CM)                    2.          DEG         YES
EMIN          1      EMIN = MINIMUM ELEVATION ANGLE (DEFAULT UNIT IS RADIANS)              20.         DB          YES
SNDV          1      SNDV = S/N THRESHOLD FOR DETECTION AND VERIFICATION (DEFAULT UNIT IS
                           RATIO(DIMENSIONLESS))                                           15.         DB          YES
SNMIN         1      SNMIN = S/N THRESHOLD FOR TRACK ((DEFAULT UNIT IS RATIO(DIMENSIONLESS))  2.5      KHZ         YES
BANDN         1      BANDN = NOISE BANDWIDTH --APPROX. 1./PULSE LENGTH (DEFAULT UNIT IS HZ)  2.5       KHZ         YES
BANDS         1      BANDS = SIGNAL BANDWIDTH --APPROX. BANDN*FPC (DEFAULT UNIT IS HZ)     1.0                     NO
FPC           1      FPC = PULSE COMPRESSION RATIO                                         1.          KM          YES
RGATE         1      RGATE = RADAR RANGE GATE FOR TRACK INITIATION (DEFAULT UNIT IS CM)    .5          KM          YES
TGATE         1      TGATE = RANGE GATE PARAMETER FOR TRACK (DEFAULT UNIT IS CM)
                                 -- RANGE GATE=TGATE+2.0*SIGMA RANGE                       500.        FT          YES
FERR          3      FERR(1-3) = FIXED PORTION OF RANDOM RADAR MEASUREMENT ERRORS IN RAE COORD   .5     MRAD        YES
                                (SIGMA(I)**2=FERR(I)**2+SNERR(I)**2/STN)                   .8          MRAD        YES
                                (DEFAULT UNITS ARE CM,RAD,RAD)                             2400.       FT          YES
SNERR         3      SNERR(1-3) = S/N DEPENDENT PORTION OF RANDOM RADAR MEASUREMENT ERRORS IN   15.     MRAD        YES
                                IN RAE COORD. (SIGMA(I)**2=FERR(I)**2+SNERR(I)**2/STN)     15.         MRAD        YES
                                (DEFAULT UNITS ARE CM,RAD,RAD)


                        3. OBJECT DATA

                           --AS MENTIONED IN SECTION C. ABOVE, THE USER CAN INPUT
                             EITHER OBJECT COORDINATES DIRECTLY (SUITABLE FOR ENDO-
                             ATM PROBLEMS) OR THE OBJECT TRAJECTORY (FOR EXO-ATM
                             PROBLEMS). THE USER MUST SELECT EITHER ONE OPTION OR THE
                             OTHER (OBJECT COORDINATES OR TRAJECTORY DEFINITION).
                             (1) TO ENTER OBJECT COORDINATES, SET OBREFER=REFER
                             AND OBTAG=OBJECT-1 (FOR A RADAR PROBLEM) AND
                             OBTAG=REF-OBJECT (FOR AN OPTICS PROBLEM) AND ENTER
                             OBTIM AND THE OBPOS AND OBVEL VECTORS.
                             (2) TO ENTER AN OBJECT TRAJECTORY, SET OBREFER=ZEROS
                             AND ENTER RLPOS,TGPOS,GAMA AND TIMP.
                           --NOTE THAT ONLY ONE OBJECT STATE OR ONE TRAJECTORY
                             CAN BE ENTERED, BUT MULTIPLE OBJECTS (NOBJ) EQUALLY
                             SPACED IN TIME (TDELT) CAN BE SIMULATED WHEN USING
                             THE TRAJECTORY INPUT OPTION.
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DIRECTORY OF INPUT VARIABLES 02/04/80 10.36.18.

Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
BETA	1	BETA = RV BALLISTIC COEFFICIENT (ALWAYS INPUT IN PSF)	1500.	PSF	YES
RCS	1	RCS = RADAR CROSS SECTION OF RV (DEFAULT UNIT IS DMSQ)	1.0	MSQ	YES
		-STATE VECTOR INPUT			
OBREFER	1	OBREFER = FLAG TO DENOTE OBJECT COORDINATES ARE BEING INPUT (SET = REFER , OTHERWISE FOR TRAJECTORY INPUT SET = ZEROS)	REFER		NO
OBTAG	1	OBTAG = FLAG TO DENOTE A RADAR OR OPTICS OBJECT IS BEING INPUT (SET OBTAG=OBJECT-1 FOR RADAR, AND OBTAG=REF-OBJECT FOR OPTICS)	REF-OBJECT		NO
OBTIM	1	OBTIM = OBJECT TIME (DEFAULT UNIT IS SEC)	99999.	SEC	YES
OBPOS	4	OBPOS(1-4) = OBJECT POSITION (OBPOS(1-3)=POSITION COORD. OBPOS(4)= COORD TYPE--GEOGR,LOCXYZ, OR RADAR) (DISTANCES IN KM, ANGLES IN DEG)	0.		NO
			50.		NO
			50.		NO
			LOCXYZ		NO
OBVEL	3	OBVEL(1-3) = OBJECT VELOCITY IN POLAR COORD (MAGNITUDE IN KM/S, HEADING COUNTERCLOCKWISE FROM LOCAL GEOGRAPHICAL EAST IN DEG, ELEVATION ABOVE LOCAL HORIZONTAL IN DEG)	7.		NO
			-90.		NO
			-45.		NO
		-TRAJECTORY INPUT			
NOBJ	1	NOBJ = NUMBER OF OBJECTS ON THE TRAJECTORY	0.		NO
BOPOS	4	BOPOS(1-4) = LAUNCH (OR BOOSTER BURN-OUT) POSITION (BOPOS(1-3)= POSITION COORD,BOPOS(4)=COORD TYPE--GEOGR,LOCXYZ,OR RADAR) (DISTANCES IN KM,ANGLES IN DEG)	0.		NO
			105.		NO
			36.		NO
			GEOGR		NO
TGPOS	4	TGPOS(1-4) = TARGET (OR IMPACT) POSITION (TGPOS(1-3)=TARGET COORD. TGPOS(4)=COORD TYPE--GEOGR,LOCXYZ, OR RADAR) (DISTANCES IN KM,ANGLES IN DEG)	0.		NO
			0.		NO
			0.		NO
			LOCXYZ		NO
GAMA	1	GAMA = REENTRY ANGLE FOR TRAJECTORY SPECIFICATION (DEFAULT UNIT IS RADIANS)	20.	DEG	YES
TIMP	1	TIMP = IMPACT TIME FOR 1-ST RV (DEFAULT UNIT IS SEC)	2000.	SEC	YES
TDELT	1	TDELT = DELTA TIME BETWEEN RVS (DEFAULT UNIT IS SEC)	20.	SEC	YES

C. SATCOM CODE INPUTS

--TO RUN A SATCOM PROBLEM, INPUT THE FIRST SATCOM CALCULATION TIME (CTIME) TO OCCUR PRIOR TO THE PROBLEM STOP TIME (TSTOP).

1. RUN CONTROL

DIRECTORY OF INPUT VARIABLES 02/04/80 10.36.18.

Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
		--SUBSEQUENT SATCOM CALCULATIONS ARE PERFORMED EVERY (CTINT) SEC.			
CTIME	1	CTIME = FIRST SAT-COM CALCULATION TIME (DEFAULT UNIT IS SEC)	99999.	SEC	YES
CTINT	1	CTINT = TIME STEP FOR SAT-COM CALCULATIONS (DEFAULT UNIT IS SEC)	30.	SEC	YES
		2. PROCESSING DATA			
		--FOR A MORE DETAILED DESCRIPTION OF THESE INPUTS SEE THE RESCUE MANUAL VOL. 20.			
CTYPE	1	CTYPE = SATCOM MODULATION TYPE (DSPR,CPSK, OR FSK)	CPSK		NO
REGEN	1	REGEN = FLAG FOR REGENERATION OF SIGNAL AT SATELLITE (YES OR NO)	YES		NO
COHNT	1	COHNT = FLAG FOR COHERENT FSK MODULATION (YES OR NO)	NO		NO
DETRM	1	DETRM = FLAG FOR FULLY DETERMINISTIC MODE CALCULATIONS (YES OR NO)	YES		NO
ORDER	1	ORDER = ORDER OF PHASE LOCKED LOOP (FIRST OR SECOND)	FIRST		NO
		3. PLATFORM DATA			
		--RELATIVE COORDINATES CAN BE USED HERE TO ALIGN THE COMMUNICATIONS LINKS AND BURST REGIONS.			
XPOS	4	XPOS(1-4) = TRANSMITTER POSITION (XPOS(1-3)=POSITION COORD,XPOS(4)=	0.		NO
		COORD TYPE--GEOGR,LOCXYZ,OR RADAR) (DISTANCES IN KM, ANGLES	0.		NO
		IN DEG)	0.		NO
			LOCXYZ		NO
RPOS	4	RPOS(1-4) = RECEIVER POSITION (RPOS(1-3)=POSITION COORD,RPOS(4)=	0.		NO
		COORD TYPE--GEOGR,LOCXYZ, OR RADAR) (DISTANCES IN KM, ANGLES	0.		NO
		IN DEG)	0.		NO
			LOCXYZ		NO
SPOS	4	SPOS(1-4) = SATELLITE POSITION (SPOS(1-3)=POSITION COORD, SPOS(4)=	0.		NO
		COORD TYPE--GEOGR,LOCXYZ,OR RADAR) (DISTANCES IN KM,ANGLES IN DEG)	0.		NO
			35787.		NO
			LOCXYZ		NO
		4. LINK DATA			
		--FIRST ENTRY IN EACH CASE REFERS TO THE UPLINK, SECOND ENTRY TO THE DOWNLINK.			
POWER	2	POWER(1-2) = TRANSMITTED POWER (UPLINK, DOWNLINK) (DEFAULT UNIT IS ERGS/SEC)	100.	WATTS	YES
			20.	WATTS	YES
CFREQ	2	CFREQ(1-2) = SATCOM FREQUENCY (UPLINK, DOWNLINK) (DEFAULT UNIT IS HZ)	8000.	MHZ	YES
			7400.	MHZ	YES
XGAIN	2	XGAIN(1-2) = TRANSMITTER GAIN (UPLINK, DOWNLINK) (DEFAULT UNIT IS RATIO	61.	DB	YES
		(DIMENSIONLESS))	33.2	DB	YES
RGAIN	2	RGAIN(1-2) = RECEIVER GAIN (UPLINK, DOWNLINK) (DEFAULT UNIT IS RATIO	16.8	DB	YES
		(DIMENSIONLESS))	61.	DB	YES

Table A.1 (Continued)

```
 INPUT       NO.                                                                                            DEFAULT               UNIT-NAME
VARIABLE   VALUES                    DESCRIPTION                                                            VALUES                ALLOWED
--------- --------  ------------------------------------------------------------------------------------  -----------------  -------

BITP         2      BITP(1-2) = BIT PERIOD (UPLINK,DOWNLINK) (DEFAULT UNIT IS SEC)                          1.0E-8    SEC        YES
                                                                                                            1.0E-8    SEC        YES
CBAND        2      CBAND(1-2) = IF FILTER BANDWIDTH (UPLINK, DOWNLINK) (DEFAULT UNIT IS HZ)                125.      MHZ        YES
                                                                                                            125.      MHZ        YES
PBAND        2      PBAND(1-2) = PLL BANDWIDTH (UPLINK, DOWNLINK) (DEFAULT UNIT IS HZ)                      125.      MHZ        YES
                                                                                                            125.      MHZ        YES
CBEAM        2      CBEAM(1-2) = TRANSMITTER BEAMWIDTH (UPLINK, DOWNLINK) (DEFAULT UNIT IS RADIANS)         1.5       DEG        YES
                                                                                                            1.5       DEG        YES
CSN          2      CSN(1-2) = SATCOM S/N THRESHOLD (UPLINK, DOWNLINK) (DEFAULT UNIT IS                     15.       DB         YES
                               RATIO (DIMENSIONLESS))                                                       15.       DB         YES

                    -------------------------------------------------------------------

                     E. OPTICS CODE INPUTS

                                --TO RUN AN OPTICS PROBLEM THE USER MUST FIRST SET
                                  OPTICS=REFER

                                --TWO TYPES OF OPTICS PROBLEMS CAN BE SIMULATED--
                                  (1) A SURVEILANCE PROBLEM WHERE THE SENSOR IS POINTED
                                  AT SOME REFERENCE LOCATION  (OTYPE=SURVEILNCE), OR
                                  (2) A BOOST TRACK PROBLEM WHERE A SENSOR LOOK IS
                                  CREATED INTERNALLY AT A SPECIFIED TIME (OTYPE=TRACK).
                                --IN THE FIRST CASE, THE USER PROVIDES THE FIRST LOOK
                                  TIME(OLOOK) AND THE REFERENCE POINT(REFPT) FOR
                                  THE LOOK DIRECTION (OR TRACK THE BURST 1 FIREBALL)
                                  (SEE SENSPT INPUT).  IN THE SECOND CASE, THE USER INPUTS
                                  THE BOOSTER MODEL AND THE BURNOUT POSITION (BOPOS).

                                  IN EITHER CASE, THE USER MUST SET UP AN OPTICAL SENSOR

                    -------------------------------------------------------------------

                         1. RUN CONTROL

                                --SUBSEQUENT OPTICS LOOKS ARE CREATED INTERNALLY EVERY
                                  (FTIME) SECONDS.
                                --OPTICS OUTPUTS ARE CONTROLLED BY THE (OCALC) PARAMETER
                                  (1) FOR (OCALC=POINTS), BOOST TRACK MEASUREMENTS ONLY
                                  ARE PRODUCED, AND
                                  (2) FOR (OCALC=FOV), DATA STREAM OUTPUT AS THE DETECTOR
                                  SCANS THE FOV WILL ALSO BE PRODUCED.
                                --THE BOOSTER MEASUREMENTS MAY BE USED TO INITIALIZE
                                  (OR ADD TO) A TRACK FILE BY SETTING (TFILE=REFER), AND
                                  THESE MEASUREMENTS MAY BE NETTED WITH RADAR DATA BY
                                  SETTING (SNET=YES).

OPTICS       1      OPTICS = FLAG FOR INITIALIZING OPTICS CALCULATION (SET   OPTICS=REFER           ZEROS                NO
```

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Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
		FOR OPTICS CALCULATIONS)			
OTYPE	1	OTYPE = OPTICS LOOK TYPE (TRACK OR SURVEILANCE)	TRACK		NO
OLOOK	1	OLOOK = TIME OF FIRST OPTICS LOOK (FOR OTYPE=SURVEILANCE) (DEFAULT UNIT IS SEC)	99999.	SEC	YES
FTIME	1	FTIME = FRAME TIME FOR OPTICS LOOKS (DEFAULT UNIT IS SEC)	10.	SEC	YES
OCALC	1	OCALC = OPTICS CALCULATION TYPE (POINTS OR FOV)	FOV		NO
TFILE	1	TFILE = OPTICAL TRACK FILE FLAG (INPUT--REFER, FOR TRACK FILE/ --ZEROS,FOR NO TRACK FILE)	ZEROS		NO
SNET	1	SNET = SENSOR NETTING FLAG (YES OR NO)	NO		NO
SENSPT	1	SENSPT = TYPE OF TARGET SENSOR IS POINTED TOWARD. USE REF FOR A FIXED POINT (REFPT), FIREBALL TO TRACK THE FIREBALL OF BURST1. NOTE-- THE USER MUST ALSO SET OBREFER=REFER AND OBTAG=REF-OBJECT-- SEE SECTION C.3 ABOVE.	REF		NO
REFPT	4	REFPT(1-4) = REFERENCE POINT FOR SENSOR POINTING (REFPT(1-3)=POSITION	0.		NO
		COORD,REFPT(4)=COORD. TYPE -- GEOGR, LOCXYZ, OR RADAR)	-79.33		NO
		(DISTANCES IN KM, ANGLES IN DEG)	47.75		NO
			GEOGR		NO

2. SENSOR DATA

--THE SENSOR LOCATION CAN BE INPUT IN GEOGRAPHICAL COORDINATES (GEOGR) OR RELATIVE TO THE REFERENCE LOCATION IN SECTION A. ABOVE.

--THERE ARE TWO WAVELENGTH BANDS ALLOWED AND THREE BUILT IN SENSOR PROCESSING MODELS. THE FIRST TWO MODELS SHOULD BE USED IN SURVEILANCE APPLICATIONS AND PROVIDE SLIGHTLY DIFFERENT OUTPUT. THE THIRD MODEL (SURVEIL-04) PROVIDES TRACK MEASUREMENT OUTPUT AND SHOULD BE USED WHEN (TFILE=REFER).

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
SNPOS	4	SNPOS(1-4) = OPTICAL SENSOR POSITION (SNPOS(1-3)=POSITION COORD,	35787.		NO
		SNPOS(4)=COORD TYPE--GEOGR,LOCXYZ,OR RADAR) (DISTANCES IN KM,	-79.33		NO
		ANGLES IN DEG)	47.75		NO
			GEOGR		NO
WLO	2	WLO(1-2) = LOW END OF SENSOR WAVELENGTH BAND --(TWO BANDS ALLOWED)	2.5E-6	M	YES
		(DEFAULT UNIT IS CM)	2.6E-6	M	YES
WHI	2	WHI(1-2) = HIGH END OF SENSOR WAVELENGTH BAND (DEFAULT UNIT IS CM)	2.6E-6	M	YES
			2.7E-6	M	YES
OFERR	2	OFERR(1-2) = FIXED PORTION OF OPTICS RANDOM MEASUREMENT ERRORS IN AE	.01	MRAD	YES
		COORD (DEFAULT UNIT IS RADIANS)	.01	MRAD	YES
OSNER	2	OSNER(1-2) = S/N DEPENDENT PORTION OF OPTICS RANDOM MEASUREMENT ERRORS IN	1.	MRAD	YES
		AE COORD (DEFAULT UNIT IS RADIANS)	1.	MRAD	YES
OMODL	1	OMODL = OPTICAL SENSOR PROCESSING MODEL --(SURVEIL-01,SURVEIL-02,OR SURVEIL-04)	SURVEIL-01		NO

3. BOOSTER DATA

--TWO BOOSTER STAGES ARE ALLOWED. NOTE THAT THE TIME CORRESP. TO THE INITIAL BOOSTER STATE IS SET INTERNALLY TO 0. SEC AND THE RV IMPACT TIME SPECIFIED IN THE

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Table A.1 (Continued)

INPUT VARIABLE	NO. VALUES	DESCRIPTION	DEFAULT VALUES		UNIT-NAME ALLOWED
		TRAJECTORY INPUTS (SEE SECTION C.3) WILL BE ADJUSTED ACCORDINGLY.			
FUEL	2	FUEL(1-2) = FUEL TYPE (LIQUID OR SOLID)--NOTE--TWO STAGES ALLOWED	LIQUID		NO
			LIQUID		NO
THRST	2	THRST(1-2) = BOOSTER STAGE THRUST (DEFAULT UNIT IS GM)	1100000.	LB	YES
			135000.	LB	YES
WTI	2	WTI(1-2) = INITIAL STAGE WEIGHT (DEFAULT UNIT IS GM)	70000.	LB	YES
			20000.	LB	YES
WTF	2	WTF(1-2) = FINAL STAGE WEIGHT (DEFAULT UNIT IS GM)	35000.	LB	YES
			8000.	LB	YES
ANOZ	2	ANOZ(1-2) = NOZZLE EXIT AREA (DEFAULT UNIT IS CMSQ)	3000.	INSQ	YES
			2000.	INSQ	YES
TBURN	2	TBURN(1-2) = STAGE BURN TIME (DEFAULT UNIT IS SEC)	0.	SEC	YES
			0.	SEC	YES
REFA	2	REFA(1-2) = REFERENCE AREA FOR AERODYNAMIC DRAG CALCULATION (DEFAULT UNIT IS CMSQ)	35.	FTSQ	YES
			35.	FTSQ	YES
CXM0	2	CXM0(1-2) = AXIAL FORCE COEFFICIENT AT M=0.5	.10		NO
			.03		NO
CXM1	2	CXM1(1-2) = AXIAL FORCE COEFFIENT FOR M=1.0	.19		NO
			.136		NO
CXM3	2	CXM3(1-2) = AXIAL FORCE COEFFICIENT FOR M=3.0	.11		NO
			.068		NO

```
DESCRIPTION OF USER INPUT AND COMMAND FORMATS . . .
```

Table A.1 (Concluded)

```
THE BASIC FORM FOR EACH INPUT LINE IS . . .

I1,I2,I3,.....

(ALL BLANKS ON THE LINE ARE IGNORED)
WHERE THE I1, I2, ETC. ARE EITHER COMMANDS OR ITEMS OF THE FORM . . .

ITEM=LIST

WHERE ITEM IS ONE OF THE INPUT VARIABLES OR VECTOR ELEMENTS AND
LIST IS A LIST OF ONE OR MORE VALUES TO BE INPUT,STARTING AT THE
NAMED ELEMENT.  THE VALUES NEED NOT INCLUDE DECIMAL POINTS FOR
WHOLE NUMBERS AND MAY BE APPENDED WITH APPROPRIATE UNIT NAMES IF
ALLOWED FOR THAT VARIABLE.  VALUES ARE SEPARATED BY COMMAS.


THE RECOGNIZED COMMANDS ARE . . .

ABORT          CAUSES PROGRAM ABORT WITH NO OUTPUT FILE
               (TO AVOID SUBMITTING A BATCH JOB)

CHANGELISTON   TURNS ON SUBSTITUTION LIST OPTION (SHOWS HOW
               VALUES ARE USED IN ROSCOE INPUT DECK)

CHANGELISTOFF  TURNS CHANGELISTON OPTION OFF

HELP           TO PRODUCE THIS MENU AGAIN

RUN            TERMINATES EXECUTION AND PRODUCES OUTPUT FILE
               FOR ROSCOE EXECUTION.  ALTERNATE FORMS ARE
                  END    OR    END DATA
```

TABLE A.2

ALLOWABLE UNIT NAMES

Category	Unit Name	Scaling Factor to Internal (Default) Units
Frequency	MHZ	1,000,000
	KHZ	1,000
Time	HRS	1 (This may only be used for time-of-day inputs)
	SEC	1
Mass	KG	1,000
	GM	1
	LB	453.592
Ballistic Coeff.	PSF	0.4882405
	GM/CMSQ	1
Length	CM	1
	FT	30.48
	KM	100,000
	NMI or NM	185,325
	M	100
	KFT	30,480
Acceleration	G	980.665
Area	CMSQ	1
	MSQ	10,000
	INSQ	6.4516
	FTSQ	929.0304

TABLE A.2 (Cont'd.)

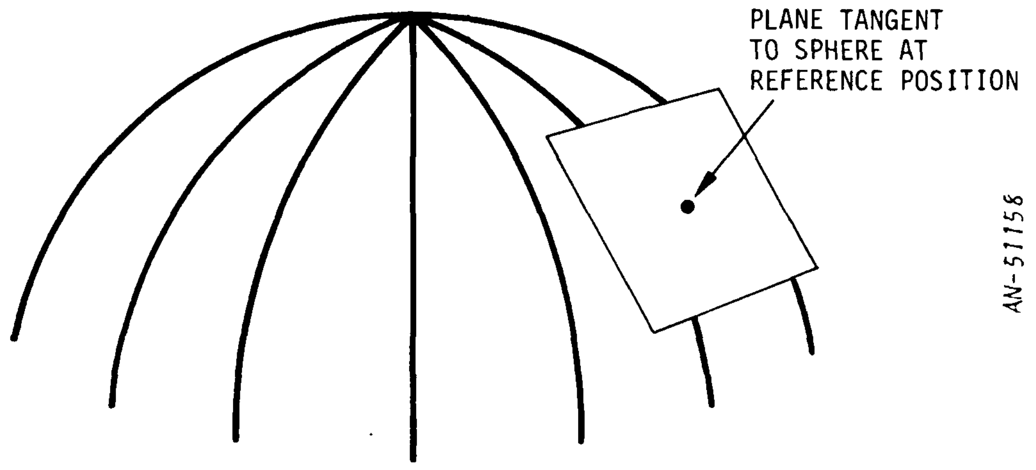
ALLOWABLE UNIT NAMES

Category	Unit Name	Scaling Factor to Internal (Default) Units
Yield	MT	1
	KT	0.001
Radar Range/Standard Target	CMSQCM	1
	KMSQM	10,000
	NMSQM	18532.5
	KFSQM	3048
Power	WATTS	10,000,000
Power Ratio	DB	X $dB \rightarrow 10^{X/10}$
Angle	DEG	0.01745329252
	RAD	1
	MRAD	0.001

TABLE A.3

POSITION COORDINATE SPECIFICATIONS

GEOGR	Geographical Coordinates: • Altitude (KM) • East longitude (DEG) (longitudes west of Greenwich input as negative) • North latitude (DEG) (south latitudes negative)
LOCXYZ	Local Tangent Plane Coordinates (see Fig. A.1): • Geographic east (KM) (west input as negative) • Geographic north (KM) (south input as negative) • Distance above plane (KM)
RADAR	Local Radar Coordinates (see Fig. A.1); • Slant range (KM) • Azimuth (DEG) (positive CCW from east) • Elevation (DEG) (positive above horizontal)



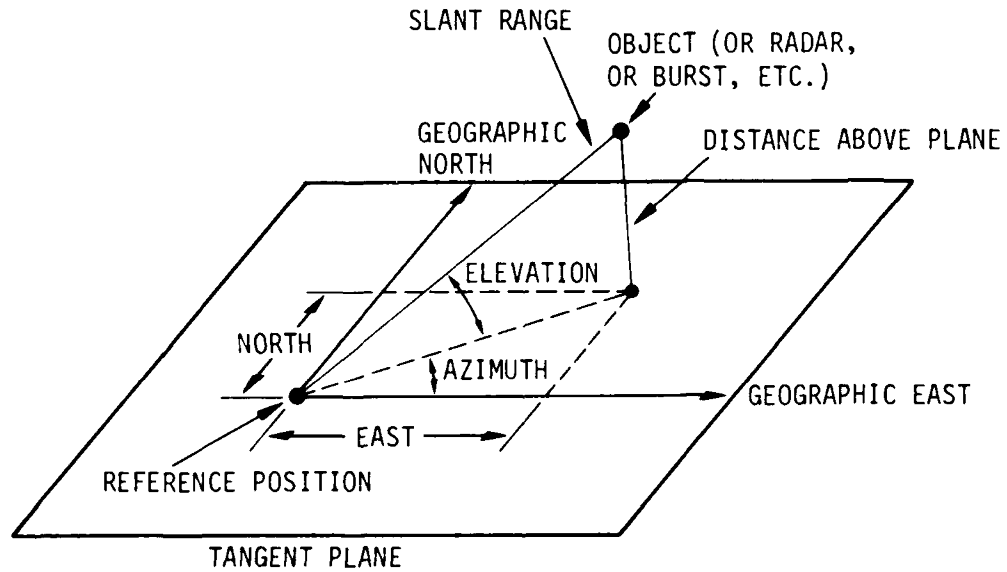


Figure A.1 Definition of Coordinates for Relative Coordinate Systems

TABLE A.4

SAMPLE CONTROL CARD DECK FOR AFWL/NOS/BE1

```
JOB CARD . . . . .
ACCOUNT CARD . . . . .
MAP(OFF)
ATTACH(XX1,OBINARY,ID=GRCXJJB,CY=1)
COPYBR(XX1,OBIN,240)
ATTACH(XX2,OBINARY,ID=GRCXJJB,CY=2)
COPYSF(XX2,OBIN)
RETURN(XX1,XX2)
REWIND(OBIN)
ATTACH(BCPYL,BCPYLROSCOE,ID=GRCXJJB,CY=3)
ATTACH(STRUCT,OSTRUCT,ID=GRCXJJB)
UPDATE(P=STRUCT,F,D,8,C=TAPE1,L=1)
BCPYL(TAPE1,OBIN,LFILE,,,REAL1,REWIND,ERRORS)
RETURN(TAPE1,TAPE4,BCPYL,OBIN)
ATTACH(SPINE,SPINEROSCOE,ID=GRCXJJB,CY=2,MR=1)
ATTACH([illegible]ROSCOE,ID=GRCXJJB,CY=5)
SPINE(,,[illegible]DATA,,,,[illegible]DATA,REWIND)
ATTACH(RLIBE,RLIBEROSCOE,ID=GRCXJJB)
RETURN(TAPE1,TAPE2,TAPE3,TAPE4,TAPE5,TAPE6)
ATTACH(AMALGM8,AMALGM8ROSCOE,ID=GRCXJJB)
AMALGM8.
RETURN(AMALGM8)
LDSET(LIB=RLIBE,PRESET=ZERO,FILES=TAPE1)
LOAD(LFILE)
NOGO.
RETURN(LFILE)
RETURN(RLIBE)
ATTACH(TAPE3,NEWDATROSCOE,ID=GRCXJJB)
SENSER.
7-8-9 CARD
*IDENT OCHG
*COMPILE STRUCT
ANY MODS TO OSTRUCT FILE GO HERE . . . . .
7-8-9 CARD
CHANGELIST ON            . . . . . (OPTIONAL)
SPINE DATA INPUTS . . . . .
. . . . .
. . . . .
RUN
7-8-9 CARD
6-7-8-9 CARD
```

TABLE A.5

SAMPLE PROCEDURE PERMFILE FOR INTERACTIVE USE

```
.PROC,ROSCOTS
COPYCR(ROSCOTS,DATDIR,2)
ATTACH(SPINE,SPINEROSCOE,ID=GRCXJJB,CY=2,MR=1)
ATTACH(INTAB,DATFILEROSCOE,ID=GRCXJJB,CY=5)
SPINE.
RETURN(SPINE,INTAB,WAFILL)
ZAP(DATDIR,WW,,IN)
COMMENT.  FILE HAS BEEN BATCHED TO INPUT.
7-8-9 CARD
JOB CARD . . . . .
ACCOUNT CARD . . . . .
MAP(OFF)
ATTACH(XX1,CBINARY,ID=GRCXJJB,CY=1)
COPYBR(XX1,CBIN,240)
ATTACH(XX2,CBINARY,ID=GRCXJJB,CY=2)
COPYBF(XX2,CBIN)
RETURN(XX1,XX2)
REWIND(CBIN)
ATTACH(BCPYL,BCPYLROSCOE,ID=GRCXJJB,CY=3)
ATTACH(STRUCT,OSTRUCT,ID=GRCXJJB)
UPDATE(P=STRUCT,F,D,8,C=TAPE1,L=1)
BCPYL(TAPE1,OBIN,LFILE,,,READ1,REWIND,ERRORS)
RETURN(TAPE1,TAPE4,BCPYL,OBIN)
COPYCR(INPUT,INDATA)
REWIND(INDATA)
ATTACH(RLIBE,RLIBEROSCOE,ID=GRCXJJB)
RETURN(TAPE1,TAPE2,TAPE3,TAPE4,TAPE5,TAPE6)
ATTACH(AMALGM8,AMALGM8ROSCOE,ID=GRCXJJB)
AMALGM8.
RETURN(AMALGM8)
LDSET(LIB=RLIBE,PRESET=ZERO,FILES=TAPE1)
LOAD(LFILE)
NOGO.
RETURN(LFILE)
RETURN(RLIBE)
ATTACH(TAPE3,NEWDATROSCOE,ID=GRCXJJB)
SENSER.
7-8-9 CARD
*IDENT OCHG
*COMPILE STRUCT
ANY MODS TO OSTRUCT FILL GO HERE . . . . .
7-8-9 CARD
6-7-8-9 CARD
```

TABLE A.6

TIME-SHARE INPUTS

(Underlined portions typed by User)

1.	COMMAND	-	ATTACH (ROSCOTS, ID = GRCXJJB)
2.	COMMAND	-	RØSCØTS
3.	INPUTS?		(USER TYPES IN INPUTS)
	INPUTS?		(USER TYPES IN INPUTS)
	.		. .
	.		. .
	.		. .
	[ERRORS	-	(--IF THERE ARE INPUT ERRORS, RØSCØTS LISTS THEM HERE AND REQUESTS INPUTS AGAIN)]
	INPUTS?		RUN

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